

Increasing the Survivability of Trees in the Urban Landscape

By Ann F. Rhoads and Paul W. Meyer

Growing trees in an urban park requires special attention to assure success since the highly modified environment of the city imposes multiple stresses. In order to better understand the factors involved, the Morris Arboretum of the University of Pennsylvania entered into a contract with the Mid-Atlantic Region of NPS for a study of Independence National Historical Park.

This 47-acre park was established in the mid-1950s in the heart of downtown Philadelphia. All but one small area contained buildings which were razed to create open space. The park has been landscaped with relatively diverse plantings over the past 25 years and now contains approximately 1,900 trees, representing 100 species or cultivars. Trees are planted in sites ranging from open lawn to curbside planting pits.

In 1976-77, the Morris Arboretum carried out a survey of the trees in Independence National Historical Park. All trees were individually evaluated for overall condition and specific insect, disease, or environmental stress problems. Where necessary, laboratory diagnoses were carried out to identify pests. Site characteristics also were noted, including the nature of the surrounding surface, the area of exposed soil, and proximity to buildings or the street. Following completion of the initial survey, spot checks of new and recurrent problems were made in 1978 and 1979.

Information regarding the adaptability of various tree species to urban growing conditions was collected and analyzed. The important stress factors limiting tree growth have been identified and cultural and maintenance practices were recommended which can increase survivability of trees in the city.

Among the specific problems affecting tree growth, soil related factors rank near the top. Excessive soil moisture due to poor drainage, soil compaction, salt accumulation, and alkaline conditions all pose severe limitations to tree growth.

Trees depend on their roots for absorption of water and dissolved minerals, anchorage, and storage of energy-rich carbohydrates over the winter. Roots are a living, growing part of the tree and must continually expand into new areas of soil to accomplish these necessary functions.

Disturbed urban soils often consist of rubble and "fill dirt" and thus bear little resemblance to a normal soil profile which includes layers of humus, topsoil and subsoil underlain by parent rock. Drainage conditions are often poor or uneven and the presence of masonry debris may create highly alkaline conditions. Organic material is usually lacking. Soil compaction is a common problem resulting from constant heavy traffic over clay and silt fill materials. Compaction reduces soil air space to the point that roots may suffocate from lack of oxygen. Compacted soil drains poorly, thereby leading to periodic conditions of water saturation which further aggravate the lack of oxygen. Another factor that can seriously reduce soil oxygen content is the production of methane in old landfill areas as buried organic debris undergo anaerobic decomposition.

The use of de-icing salts on streets and sidewalks results in salt buildup in curbside planting pits and causes leaf scorch and eventual death of such sensi-

tive trees as maples and lindens.

Trunk wounds are a commonly occurring form of mechanical damage, especially on curbside trees. These wounds frequently become entry points for wood decay fungi, other pathogens, and insects. Basal wounds also are common on lawn specimens as a result of poor maintenance practices. Repeated wounding with lawn mowers has weakened plants and led to invasion by crown canker and other disease and insect problems.

Another form of mechanical damage results from vandalism. Branches and entire trees have been broken off when nursery stock was not of sufficiently large size.

Air pollution injury caused by the photochemical pollutant ozone is likely to occur on certain sensitive plants. In Philadelphia, ozone damage, which consists of a fine dark red or black stippling of the upper leaf surface, has been found on White Basswood, Sweetgum, Cockspur Hawthorn and London Planetree. In general, this injury does not appear to be a serious threat to tree health. Occasionally, a very sensitive plant may be affected to the extent of partial defoliation.

Temperature is another problem. Extremes of heat or cold can cause damage in some plants. Summer heat, reflected from surrounding surfaces, can cause leaf scorch. In winter, bark scald and/or frost cracks develop when tree trunks are sun-warmed and undergo rapid changes in temperature. Species with dark colored bark are more susceptible to winter damage than those with light colored bark.

Insect and disease problems increase in incidence and severity when trees are subjected to environmental stress. Soil compaction, salt, extremes of temperature, air pollution and mechanical wounding all reduce a tree's natural defenses and its ability to resist threats to health. One or more of these stress factors are common in most city planting sites. The pest problems cited below were found to be most prevalent in the survey of Independence NHP.

Scale insects are widespread in urban planting.

Obscure Scale is especially troublesome on Red Oak, Scarlet Oak, and Willow Oak growing in curbside planting pits. Kermes Oak Scale is often present on these same species. Severe infestations of scale can seriously weaken trees and even kill them. Trees in open lawn settings are less frequently infested, presumably due to the reduced degree of stress under which they are growing.

Bagworms are another common pest in city plantings. These caterpillars feed on the leaves of deciduous and evergreen trees. Concealed in bags constructed of silk and bits of plant debris which hang from the branches, they are most visible in the winter-time.

Another insect problem, which may be unique to city planting sites, is termites. The Eastern Subterranean Termite may attack apparently vigorous and otherwise intact young trees. In one location in Independence Park, termites invaded newly planted Ginkgo and Thornless Honeylocust trees under cover of the paper trunk wrap used to protect the trees from sunscald.

Borers are another category of insects frequently found in urban plantings. The Lilac Borer attacks Ash and Lilac; the Dogwood Borer and Rhododendron Borer also are troublesome.

Certain disease problems caused by parasitic fungi, bacteria, viruses and nematodes are to be expected in city plantings. In some cases, increased disease susceptibility is clearly related to environmental stress factors. The severe problem with Bleeding Necrosis disease of Sweetgum trees in Independence Park is an example. Susceptibility to the fungus which causes this disease has been associated with low moisture and low temperature stress.

Foliage diseases, although unsightly, are not as serious a threat to tree survival. In a number of cases, disease incidence can be reduced through use of resistant cultivars. Anthracnose of London Planetree is common in cities where this tree has been used extensively in street plantings. In a cool, wet spring, this disease can cause nearly complete defoliation. How-



Honeylocust trees shade Locust Street in Independence National Historical Park.

ever, the trees will recover within a month or so. The London Planetree cultivar, Bloodgood, resistant to anthracnose, has performed exceptionally well in Independence Park. Apple scab and Powdery Mildew are common on susceptible crabapple trees. Resistant cultivars are available and should be specified in all cases.

Species diversity emerged as a major deterrent to plant problems in city parks. Far too often entire parks are planted with only two or three kinds of trees. This not only leads to a visually dull landscape, but it also can create later horticultural problems if insect or disease problems arise.

The devastation wrought by Dutch Elm Disease is a classic example of the danger of overuse of a single tree species. The American Elm, once planted almost exclusively in many areas of the northeast and mid-west, has been virtually wiped out as Dutch Elm Disease swept across the country. By increasing the diversity of species selected for our urban landscapes, the potential for similar devastating epidemics can be minimized.

Increased survivability for urban park trees can be promoted in two equally important ways; one way involves plant selection and the other, site preparation.

A knowledge of the cultural requirements and adaptability of tree species and cultivars is essential to planning a successful, low maintenance urban planting. Only salt-tolerant species should be planted in areas where de-icing salts will be used. Selections with resistance to specific pest problems should be used in areas where the pests are known to occur. Avoiding a problem is always preferable to having to treat it later. Some examples which are now available, in addition to anthracnose-resistant varieties of London Planetree, are scab and rust-resistant crabapples, species of elm resistant to Dutch Elm Disease, and even tree species which the gypsy moth avoid (native American tulip tree). Large plantings should always contain a diversity of species to minimize the spread of specific pests.

Site preparation is equally important. Where plants



Ann Rhoads and Paul Meyer inspect a newly planted tree in Independence National Historical Park.

are to be part of the urban landscape, site design should take into consideration the biological needs of living plants. In existing areas, some modifications to provide more favorable growing conditions may be possible. Improved drainage and reduction of soil compaction may be accomplished by construction of raised planting beds. In addition, planting trees three to four inches above grade will help to alleviate problems arising from reduced soil oxygen content.

Additional root space can be accomplished also by constructing expanded or interconnected tree pits partially topped with bricks or paving stones laid in

sand. Trees in lawn areas should be planted high and protected from mechanical injury by a mulched zone at least three feet in diameter.

Living trees are a valuable addition to the urban park. Their significance warrants more attention to site preparation, selection and care. Reduced stress on trees will result in increased survivability and reduced maintenance costs.

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